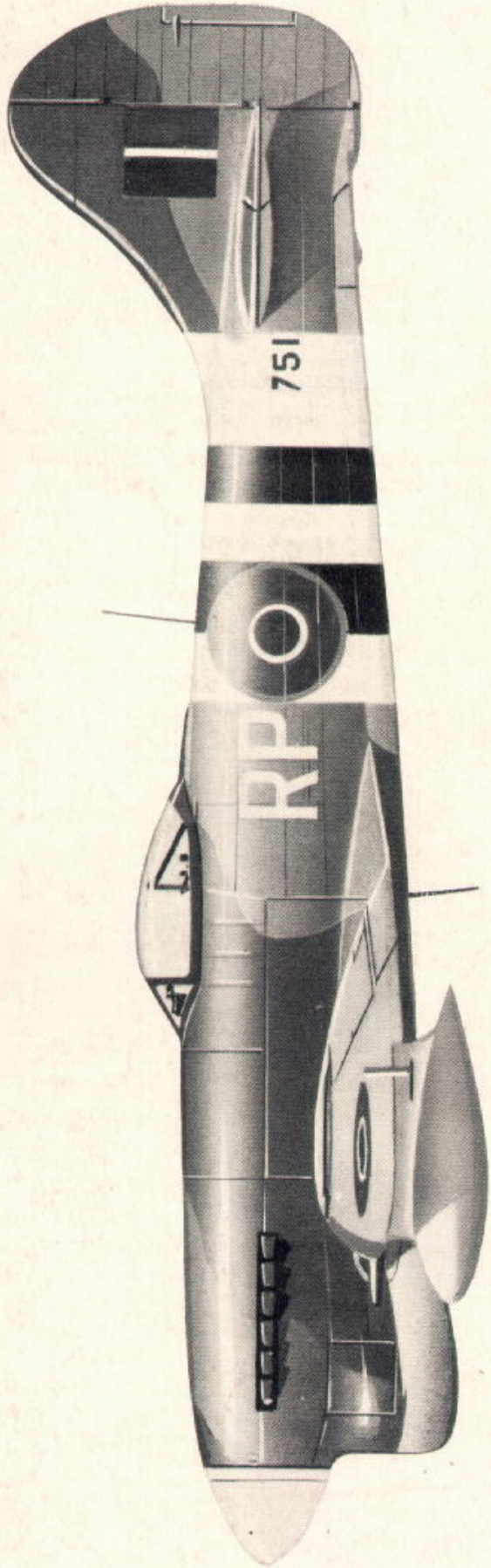
PROFILE
PUBLICATIONS

The Hawker Tempest I-VI



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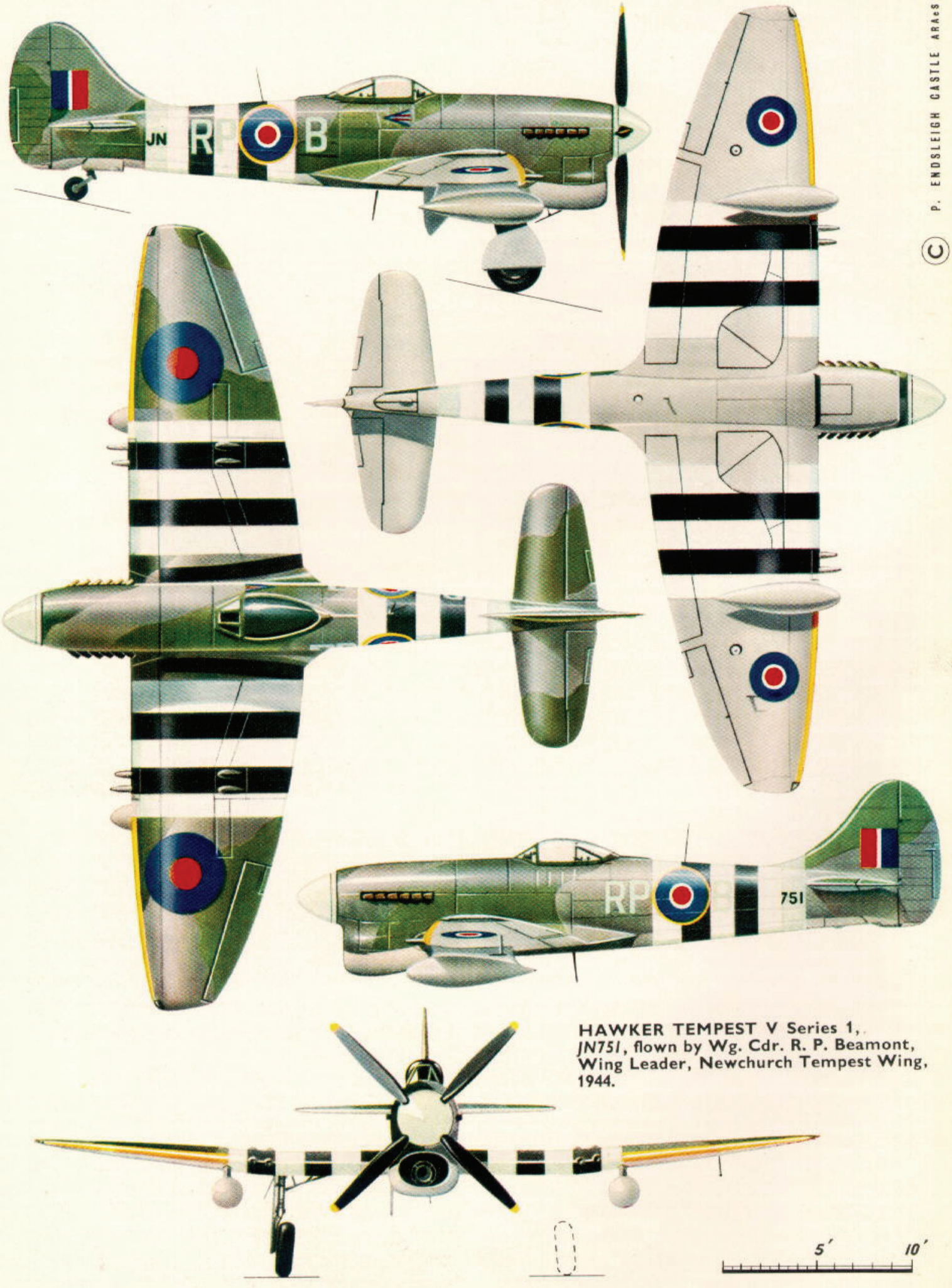

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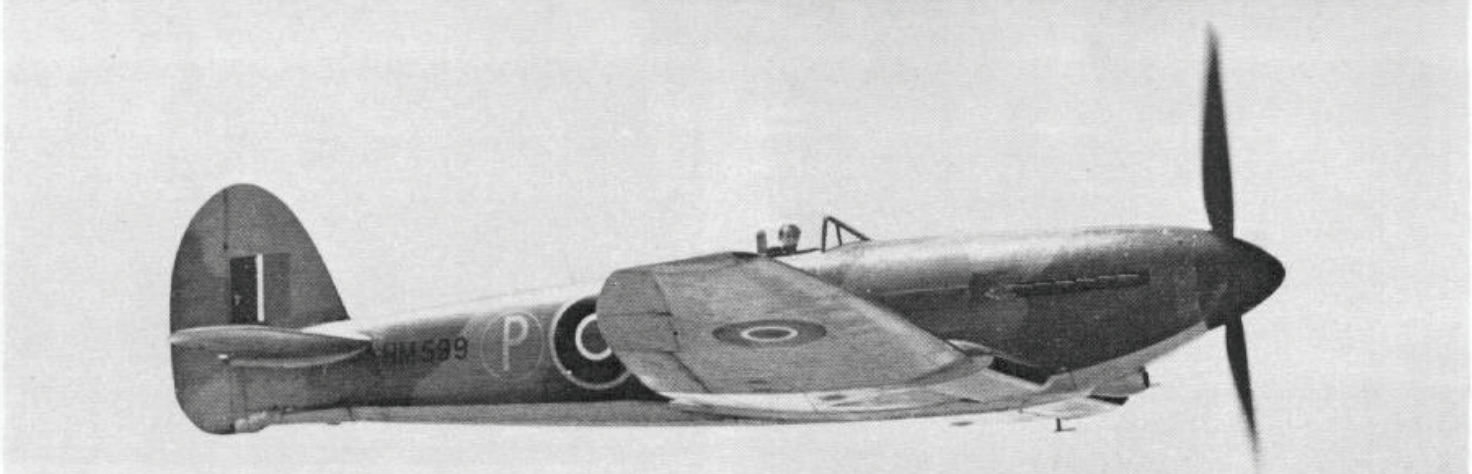
HAWKER TEMPEST V Series 1,
JN751, flown by Wg. Cdr. R. P. Beamont,
Wing Leader, Newchurch Tempest Wing,
1944.

5′ 10′



The Hawker Tempest I-VI

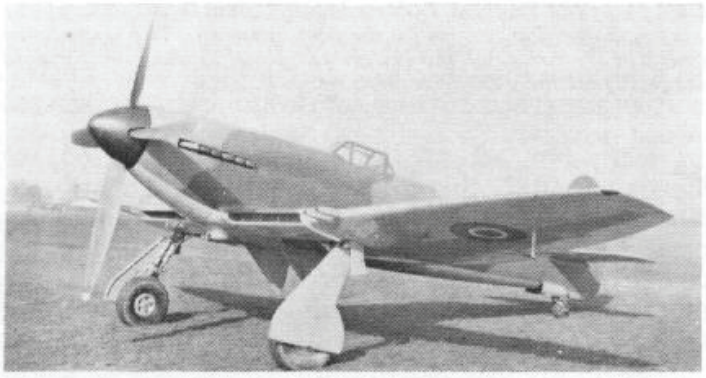
by Francis K. Mason

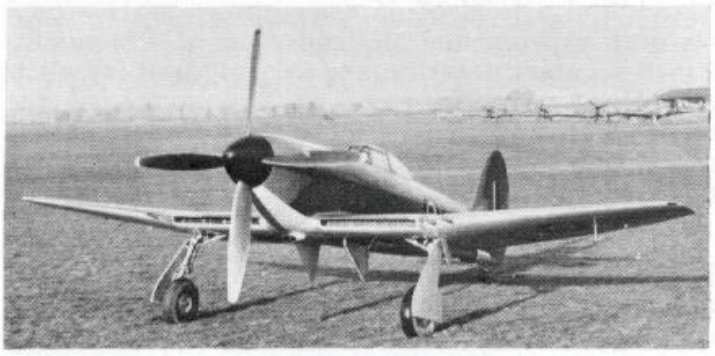
The clean lines of the Tempest I HM599 *displayed by Bill Humble during 1944. Note the forward position of the oil cooler under the nose, and the single-piece sliding hood.*
(Photo: F. K. Mason Collection)

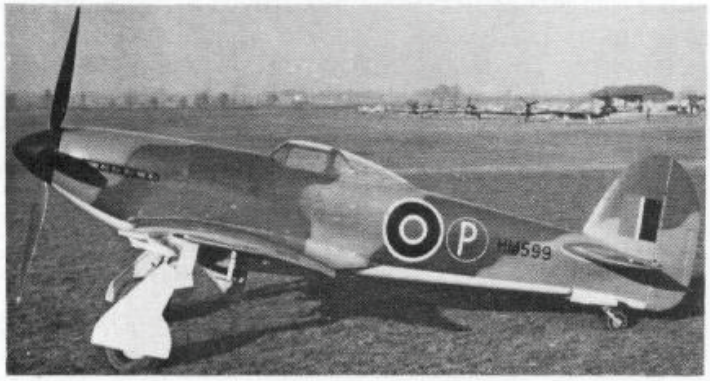
The Tempest was one of the relatively small number of entirely new Allied fighters designed and developed after the outbreak of the Second World War which saw service during the War. That it came to be developed in the short time that it was, however, suggests that it owed design allegiance to the Hawker Typhoon, yet it is certainly true that it was the very design and performance deficiencies of the Typhoon that spurred the Hawker design team to seek a remedial concept.

It may be recalled that on entry into service in 1941, the Typhoon (see *Profile* No. 81) displayed all the symptoms of abbreviated and inadequate development, with powerplant unreliability, a lack of structural integrity and a total inability to perform interceptor duties at any height above medium altitudes. The truth lay in the design resources available when the Typhoon was conceived in 1937, for it should be remembered that the 20-mm. Hispano gun was something of a novelty and the depth of wing section had been to some extent dictated in the belief that great strength would be demanded by a battery of four such guns. The alternative armament of twelve machine guns suggested that wing thickness should be maintained towards the tip. The NACA 22-series section with 18 per cent thickness/chord ratio chosen, associated with a relatively low aspect ratio, thus deprived the Typhoon of its performance at high altitude—even if its recalcitrant Sabre continued to provide power to get it there!

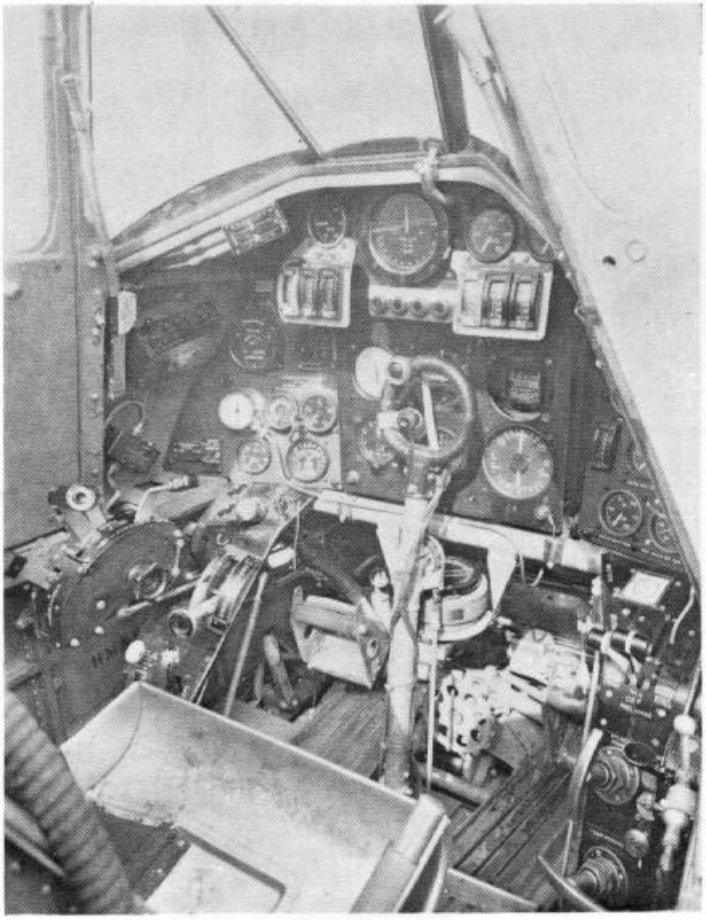
Early flight trials of Typhoons in 1940 had suggested the performance deficiencies to Sydney Camm, and his project team commenced a design study of the Typhoon using a new elliptical wing with a root thickness/chord ratio of 14·5 per cent, thinning to 10 per cent at the tip, maximum thickness occurring at 37·5 per cent of the chord. This resulted in a reduction of wing root thickness of five inches compared with that of the standard Typhoon and the elimination of the wing fuel tanks. The removal of these tanks however permitted installation of wing radiators, a recourse long favoured by Camm—but never previously achieved by him. The fuel was "moved" to the fuselage after lengthening the nose by adding







Early ground views of Tempest I HM599 *showing the car-door canopy, aft position of the oil cooler and installation of wing gun dummies.*
(Photos: Ministry of Defence, Neg. No. 12162B, and Hawker Aircraft Ltd., Neg. Nos. 1137 and 1139)



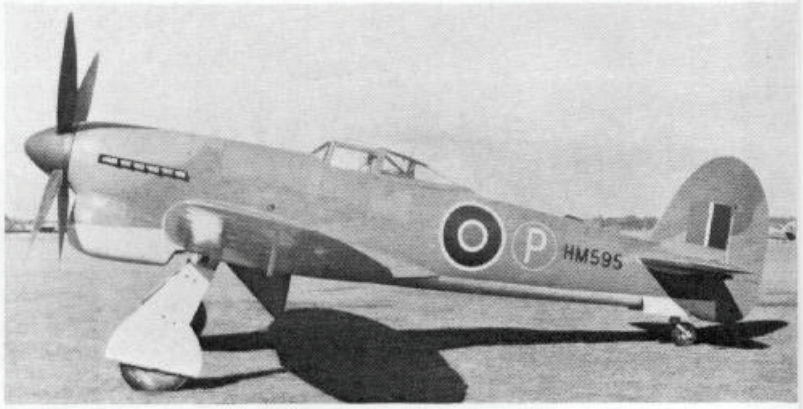
Cockpit of the Tempest I whose identification is provided by the wing radiator flap control on the port coaming. The large boost gauge in the centre of the instrument panel in place of gunsight suggests that the guns have been omitted.
(Photo: Ministry of Defence, Neg. No. 12162G)

an extra bay aft of the engine. Designated the Hawker P.1012, this design was the subject of discussions between Camm and the Director of Technical Development in February 1941, and in the course of these talks the first installation drawings of the new Napier Sabre EC.107C (later developed as the Sabre IV) were made available to Hawkers.

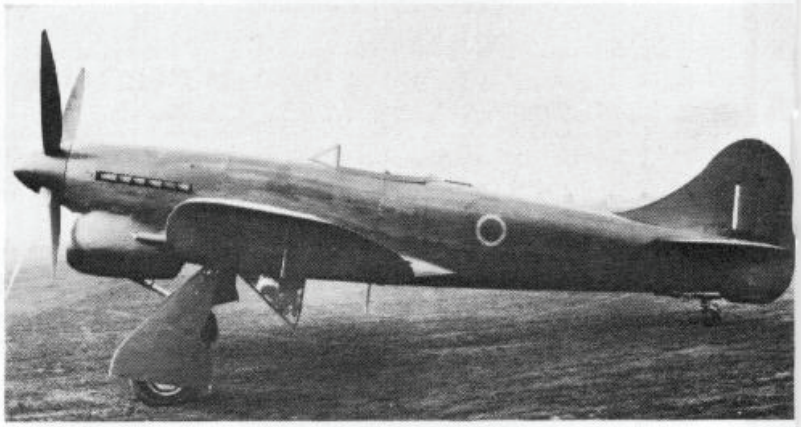
Sanction to proceed with the design, now generally referred to as the Typhoon II, was confirmed in March and a total of 45 draughtsmen at Hawkers' wartime experimental design office at Claremont, Esher, set about transforming the proposals into fact. Air Ministry Specification F.10/41 was prepared that month and on 18th November 1941 a contract was raised with Hawker Aircraft Limited for two prototypes, *HM595* and *HM599*.

PROTOTYPES AND PROBLEMS

Thus far the proposals had advanced smoothly and the basic design changes seemed likely to overcome the weaknesses by now being confirmed by the Typhoon in service. Complications however set in with a vengeance, for the Rolls-Royce Vulture engine programme had recently been cancelled and with it the Hawker Tornado development. Parallel with the Typhoon, the Tornado had been proposed with a

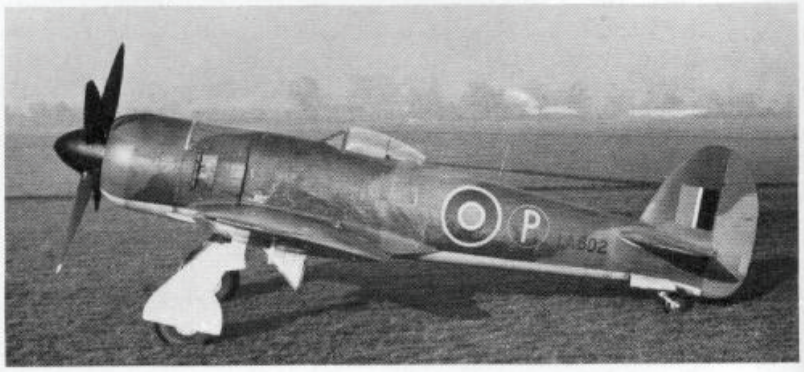


Earliest known photo of the Tempest V prototype, HM595, *illustrating the original Typhoon tail unit and car-door canopy.*
(Photo dated 9/42, Ministry of Defence, Neg. No. 10983C)



A much later photo of HM595 (*possibly in Mk. VI prototype configuration*). (Photo: Ministry of Defence, Neg. No. 13560)

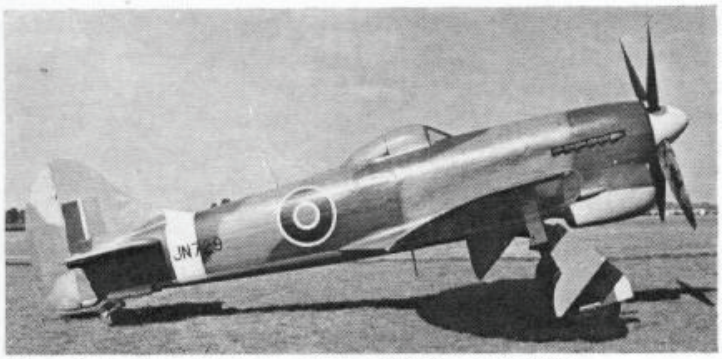
The first Tempest II prototype, LA602, *with Centaurus IV and Typhoon tail unit.*
(Photo: Hawker Aircraft Ltd., Neg. No. 2TG2)

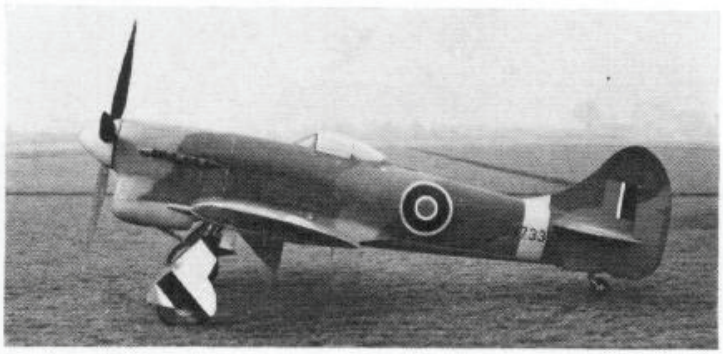


host of alternative engines apart from the Vulture, and the first of such prototypes (*HG641* with a Bristol Centaurus C.E.4S) had been flown by Philip Lucas at Langley on 23rd October 1941.

The remaining five Tornado prototypes (*HG636-HG640*) were cancelled and the Centaurus programme transferred to the Typhoon II. Notwithstanding it was clear in early 1942 that the refinements being applied now justified renaming the project and, with logical alliteration, the name Tempest was formally adopted on 28th February 1942. The place of the cancelled Tornado prototypes was taken by five

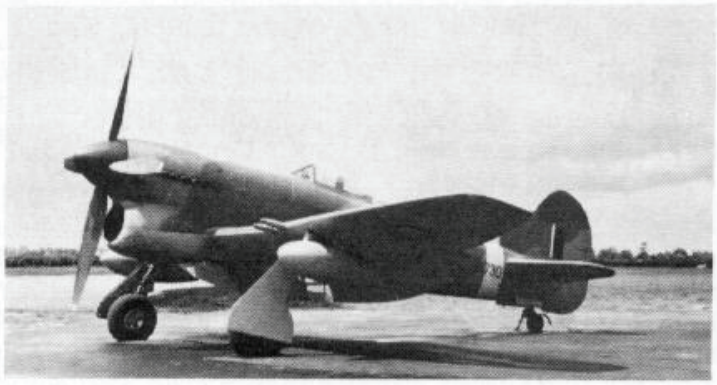
Serial	Engine	Tempest prototype version	First Flown	Remarks
HM595	Sabre V	Mark V and VI	2nd Sept. 1942	Also fitted with Sabre II.
HM599	Sabre VI	Mark I	24th Feb. 1943	Project abandoned.
LA594	Centaurus IV	(Mark II)	Not flown	Originally Centaurus-Typhoon II. Abandoned.
LA602	Centaurus IV	Mark II	28th June 1943	First Centaurus-Tempest.
LA607	Centaurus IV (and others)	Mark II	18th Sept. 1943	Used for Centaurus development.
LA610	Griffon IIB	Mark III	27th Nov. 1944	Completed as F.2/43 Fury with Griffon 85.
LA614	Griffon 61	Mark IV	Not flown	Project abandoned.





Two views of early Tempest Vs, JN729 *and* JN733.

(Photos: Hawker Aircraft Ltd., Neg. Nos. 5TG11 and 5TG34)



(Left) *Tempest V* JN730 *was used by Hawkers to clear the use of 45-gallon drop tanks. This photo also gives some idea of the large flap area available on the Tempest.* (Right) *Clearance for rocket firing was obtained on the Mark V Series 2,* NV946.
(Photos: Hawker Aircraft Ltd., Negs. Nos. 5TG48 and TRP1)

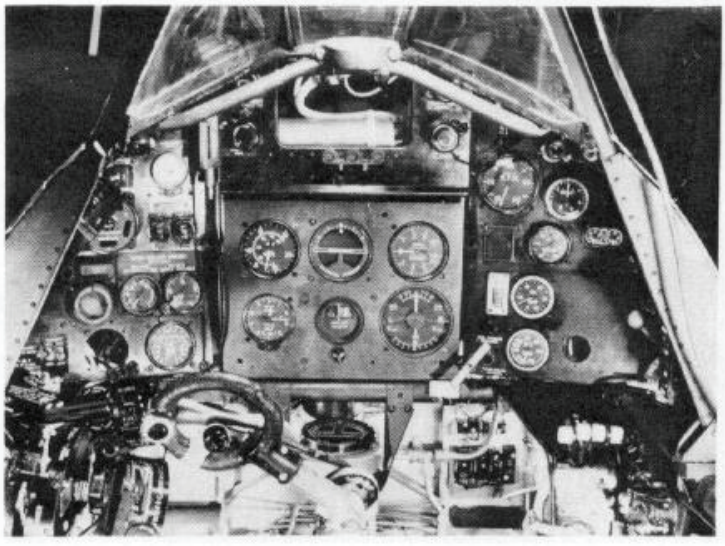
Tempests *LA594*, *LA602*, *LA607*, *LA610* and *LA614*, and the table on p. 4 will assist in clarifying their complicated fortunes.

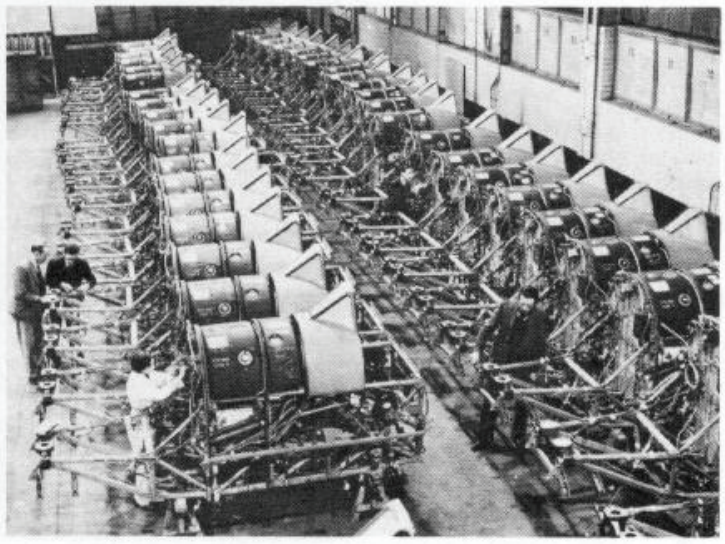
Spurred by the extraordinary sufferings of the Typhoon in 1942, production contracts for 400 Tempest Is were placed with Hawker in August that year before even the first prototype had flown. Such was the urgency with which these contracts were pursued that 300 of the Tempests (between *EJ504* and *EJ896*) replaced a similar number of Typhoons previously contracted with Gloster Aircraft Company in an effort to use prefabricated Typhoon components. As events transpired the production Tempest had diverged so far that no benefit resulted, and as the Typhoon emerged as an effective ground attack fighter in its own right, heavy re-ordering of Typhoons more than compensated Gloster for its earlier cutback.

Difficulties with the Sabre IV and its associated wing radiators so delayed *HM599* that it was the more conventional Sabre V-powered Tempest V that first flew, and the production contracts were transferred to this version.

The Tempest I, despite its failure to achieve production, was nevertheless a most attractive design. The surprisingly slim, smooth contours of the nose cowling belied the bulk of the Sabre engine and the elimination of the "beard" radiator transformed the general Typhoon ugliness into something almost Spitfire-like, and the elliptical wing heightened this similarity. Even the car-door canopy enclosure was replaced by the exceptionally clean single-piece sliding hood. It was the limited development of the Sabre IV that critically delayed this 466 m.p.h. version; moreover, undeterred by the success enjoyed by the Mosquito, an Air Staff member even expressed to Camm his doubts concerning the vulnerability to battle damage of the wing radiators. It is interesting to record that the "unbearded" Sabre installation had been developed by Hawkers in their twin-Sabre VIII P.1005 high-speed bomber project designed to

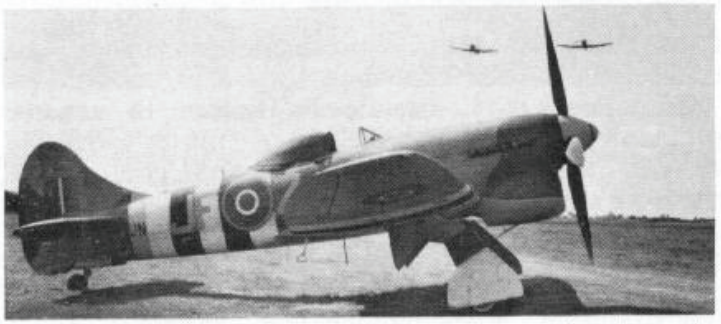
(Left) *Cockpit of the Tempest V. The gunsight has been omitted for test purposes.* (Photo: Hawker Aircraft Ltd., Neg. No. 5TG46)
(Right) *The stockpile of Tempest centre-fuselage sections that resulted from the labour dispute at Hawker during 1944.*
(Photo: F. K. Mason collection)





The Tempest V, JN751, *flown by Wg.Cdr. R. P. Beamont as Wing Leader of the Newchurch Wing. Scarcely visible is the rank pennant painted on the fuselage near the windscreen.*
(Photo: Imperial War Museum, Neg. No. CH13959)

A No. 486 Squadron (R.N.Z.A.F.) Tempest V Series 1 on Newchurch airfield in mid-1944.
(Photo: Imperial War Museum, Neg. No. CH13955)



Tempest V Series 2 of No. 3 (F) Squadron. This photo also probably taken at Newchurch shortly after D-Day, 6th June 1944. (Photo: Imperial War Museum, Neg. No. CH14095)

No. 3 Squadron Tempest Vs almost certainly at Venlo, Holland, about the time of the German Operation Hermann. Shortly afterwards the Squadron erased the invasion stripes and added the unit emblem on the fin.
(Photo:
Imperial War Museum,
Neg. No. CL1418)

Spec. B.11/41. Though two prototypes of this bomber, *HV266* and *HV270*, had been ordered, the project survived no further than the mockup stage. Rather later a Sabre V was flown experimentally in a Tempest V (*NV768*) fitted with an annular radiator and "radial" cowling; later still a huge ducted spinner was added.

As shown in the foregoing table, neither the Tempest III or IV came to fruition, partly as the result of priorities accorded to Griffon-powered Spitfires; nevertheless *LA610* was finally completed as one of the F.2/43 Fury prototypes (see *Profile* No. 126, the Hawker Sea Fury) and ultimately became the fastest of all Hawker piston-engine fighters, with a Sabre VII which bestowed a top speed in the region of 485 m.p.h.

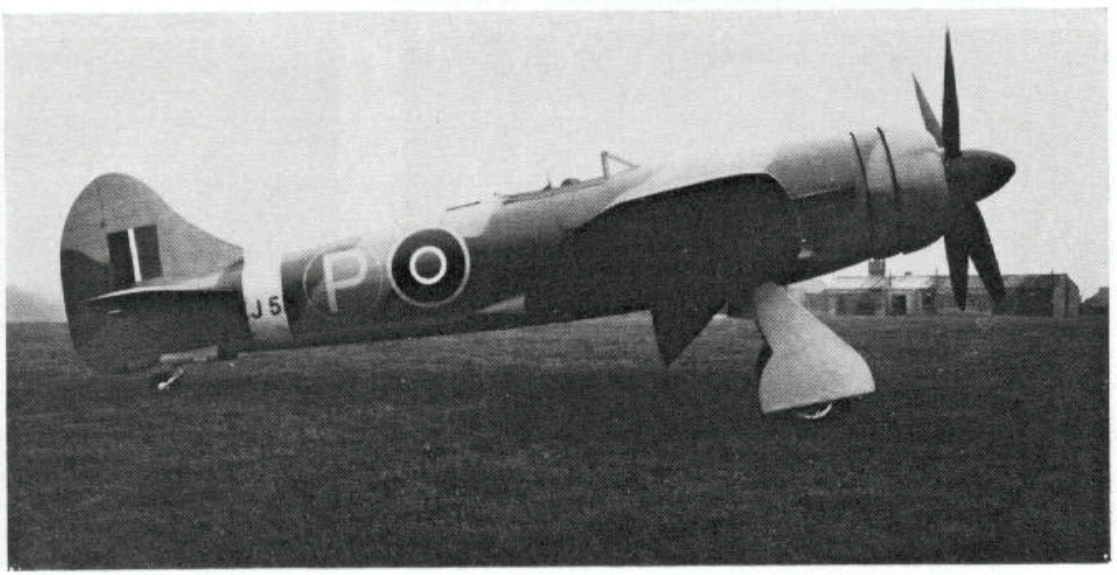
The Tempest II, victim of continuing delays with the eighteen cylinder Bristol Centaurus radial engine, was not to see service during World War Two, and will therefore be dealt with chronologically.

MARK FIVES VERSUS V.1s

HM595 underwent considerable development during 1943, reverting to the Napier Sabre IIA of the Typhoon (complete with beard radiator) which was now considered reliable. It had commenced life with a standard Typhoon tail unit, suitably strengthened, but to this was added a dorsal fin fairing, and the tailplane and elevator were increased in size. The retractable tailwheel was enclosed by doors, and the Hispano Mk. I 20-mm. guns—being accommodated further aft in the wings than in the Typhoon—only protruded to half the extent of the earlier design. This general tidying up of the design resulted in a maximum speed of 436 m.p.h. at 18,500 feet.

Meanwhile, in parallel with the continuing Hurricane assembly lines, production of the Tempest V got under way at Langley, and the first aircraft, *JN729*, was flown by Bill Humble on 21st June 1943. The first 100 off the line were designated Mark V Series 1 and were armed with Mark II Hispano guns, but thereafter Sabre IIBs, fully-buried Hispano Mk. V guns and spring-tabbed ailerons identified the early Tempest V Series 2.

Production was slow to accelerate however, due, it was said, to manufacturing difficulties with the rear spar. Most of the early aircraft were delivered to Boscombe Down for Service armament trials during which clearance was achieved to carry rocket projectiles, 1,000-pound bombs, oil bombs and mines.



First of the annular radiator Tempest Vs, EJ518.
(Photo: D. Napier & Son,
Neg. No. 1940W)

The Service pilots voiced their appreciation that, unlike the Typhoon, the Tempest was buffet-free well beyond 500 m.p.h. in dives, and by virtue of the spring tabs remained fully controllable without aileron reversal at these high speeds. At take-off weight, carrying bombs, the wing loading in similar configurations, had been reduced to 44.7 lb./sq.ft. from the 47.4 lb./sq.ft. of the Typhoon; be that as it may, the Tempest was certainly—in the words of a well-known pilot—a man-sized aeroplane. During 1944 it was flown by experienced U.S.A.A.F. pilots over the south of England in numerous analytical mock combats with other Allied fighters and, although considered to be slightly inferior to the P-51D Mustang, "it ran rings round the P-47D Thunderbolt". It was generally assessed as the R.A.F.'s best fighter to reach service before VE-Day.

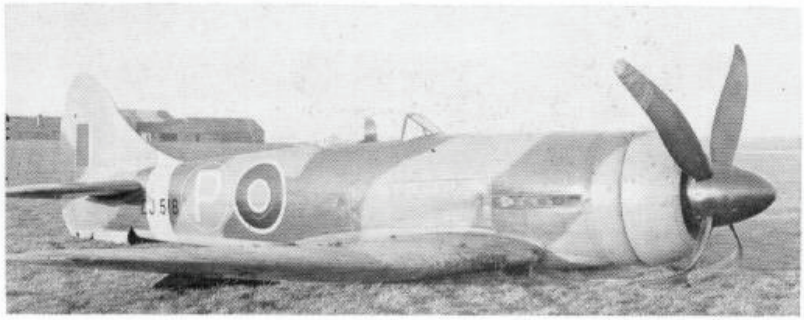
Having attained general clearance on 8th April 1944 (by which date 186 aircraft had been assembled at No. 5 Maintenance Unit at Kemble, and 68 at No. 20 M.U. at Aston Down), fifty Series 1 Tempest Vs were delivered to Newchurch airfield on the Romney Marshes in Kent. Here, under the command of Wg. Cdr. R. P. Beamont, D.S.O., D.F.C.*, No. 3 Squadron of the R.A.F. and No. 486 Squadron, R.N.Z.A.F., formed the first Tempest Wing, the new aircraft replacing Typhoons. Two months later another Typhoon squadron, No. 56, also received Tempests.

Prior to D-Day the Tempests penetrated into Northern France and the Low Countries, attacking with guns and bombs airfields, radar installations, coastal shipping and the nebulous "ski sites" that, only half-suspected at the time, were soon to discharge the vicious flying bomb offensive against Southern England. In the few air combats that occurred during this phase, the Tempest was supreme, and only the least experienced pilot fell prey to the depredations of the *Luftwaffe's* best pilots and fighters, the Messerschmitt Bf 109G's and Focke Wulf Fw 190's of JG 27 and JG 2.

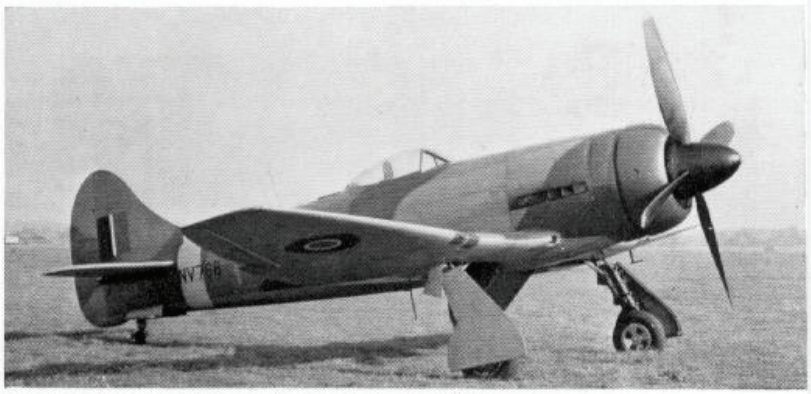
It was immediately after the Normandy landings however that the build-up of Tempest squadrons gained momentum, hastened by the onset of the flying bombs. Nevertheless the responsibility for metropolitan air defence against the flying bomb rested upon A.D.G.B. (Air Defence of Great Britain, as distinct from the 2nd Tactical Air Force, an autonomous force that covered Allied operations in Northern Europe), and although squadrons of Spitfires, Mustangs, Mosquitos and the early Meteors constituted a fair proportion of this defence, situated as they were so close to the active launching sites and possessing the higher performance, the Tempests of the Newchurch Wing played a major part in blunting this attack. It was officially recorded that of the R.A.F.'s total score of 1,771 flying bombs destroyed between 13th June and 5th September 1944, the Tempests alone shot down or otherwise destroyed in the air 638—or more than one in three.

It has been suggested that during the critical V.1 attacks, in view of the known superiority of the Tempest, the build-up of squadrons thus equipped could have been faster, yet the reason that this could not be achieved lay in the Hawker assembly shops where a labour strike in the wings section at the height of the flying bomb attacks delayed these components while stocks of fuselages built up. However despite this shortlived setback, by September five Tempest squadrons operating a total of 114 aircraft were at first line strength against the bombs.

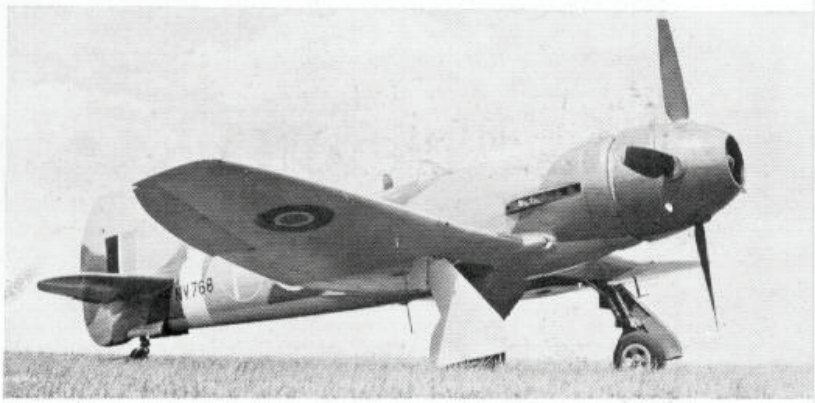
From mid-July Tempest Vs arriving on the squadrons had provision for wing fuel tanks each con-



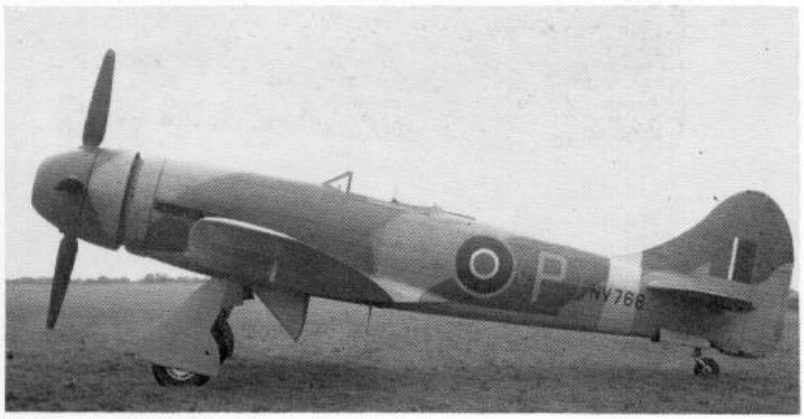
EJ518 *comes to grief.* (Photo: F. K. Mason collection)



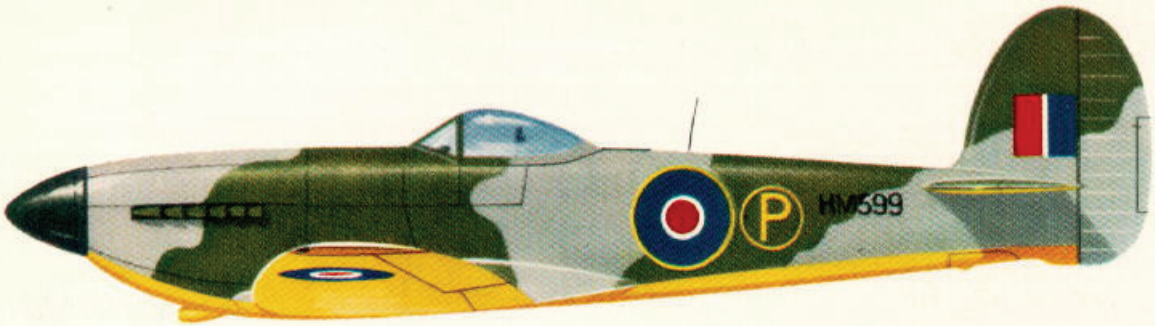
Second aircraft with annular radiator, NV768.
(Photo: D. Napier & Son, Neg. No. 2489)



Two views of NV768 *with annular radiator and ducted spinner.*
(Photos: D. Napier & Son, Neg. Nos. 1828 and 2366)

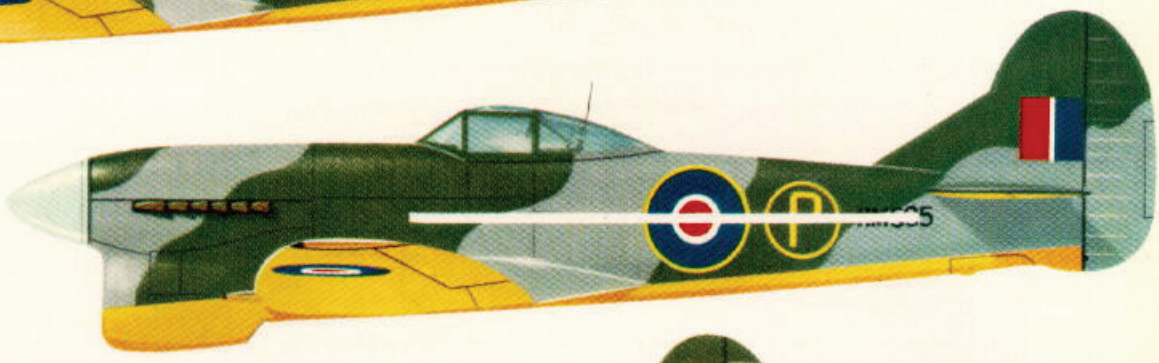


* *Roly Beamont had previously been seconded to Hawker Aircraft Ltd. during early Typhoon development in 1941 and later commanded one of the first Typhoon squadrons (No. 609). He subsequently returned to Hawkers in 1943 during the Tempest test programme and then led this aircraft into service and into battle.*



Tempest Mk. I prototype; Langley, U.K., 1943. Serial *HM599*.

Tempest Mk. V prototype with interim dorsal fin; Boscombe Down, U.K., January 1943. Serial *HM595*.



Stylised "V1" marking, two under cockpit of *NV706*.

Tempest Mk. V of No. 486 (New Zealand) Squadron; Venlow, Holland, January 1945. Serial *NV706*.

Tempest Mk. V of No. 501 "County of Gloucester" Sqn., R.A.F., Hawkinge, U.K., 1944/45. Serial *EJ605*.

Tempest Mk. V of No. 33 Sqn., R.A.F.; British Air Force of Occupation, Germany, 1946. Serial *SN161*; note squadron commander's pennant under cockpit.

Tempest TT 5 of Armament Training Station; Sylt, Germany, 1947. Serial *SN209*.

Tempest Mk. V flown by Air Marshal Sir Roderick Hill, 1946. Serial *JN876*.

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Tempest Mk. II prototype; Langley, U.K., July 1943. Serial *LA602*.

Tempest Mk. II of No. 13 O.T.U., 1945. 'SNAKE' marking indicates that aircraft was originally earmarked for Far East operations. Serial *MW750*.

Tempest Mk. II of No. 33 Sqn. R.A.F.; B.A.F.O., Germany, c.1946. Serial *PR787*.

Pakistani Air Force, early roundel.

Tempest Mk. II, of No. 30 Sqn. R.A.F.; India, 1946. Serial *PR566*.

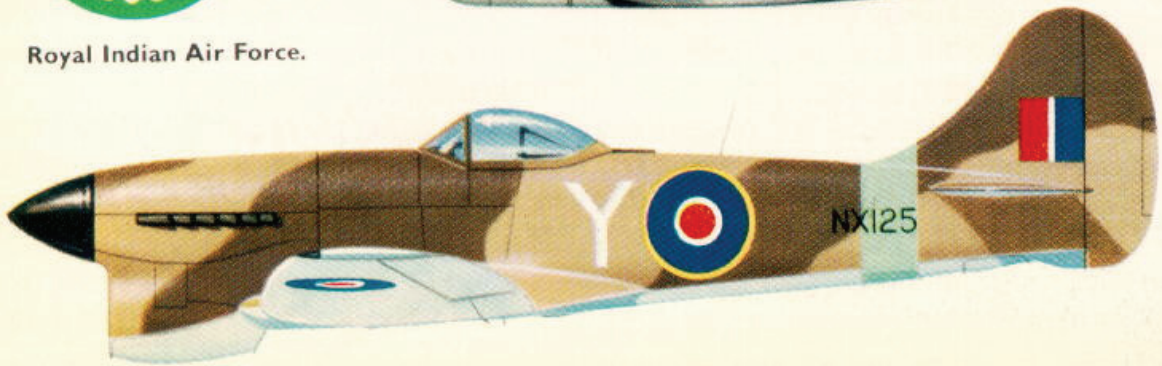
Tempest Mk. II *A145* of No. 14 Sqn., Pakistani Air Force; Mirenshah, 1950.

Pakistani Air Force.

Tempest Mk. II of No. 7 Sqn., Royal Indian Air Force; Poona, India, 1949

Royal Indian Air Force.

Tempest Mk. VI of No. 249 Sqn. R.A.F.; Habbaniyah, Iraq, 1948. Serial *NX125*.



© WARRD—

taining 28 gallons, and when the V.1 campaign reached its height R.A.F. fighters were withdrawn from the coastal belt to allow ground defences free rein, so that when now flying with full internal tanks of 162 gallons capacity plus two 45 gallon drop tanks, the Tempest could maintain a worthwhile standing patrol of up to 4½ hours off the South Coast in the path of approaching bombs.

The tactics employed by Tempest pilots varied slightly according to visibility conditions but, unlike other aircraft which required to dive on their targets owing to their slender speed margins, the Tempests usually patrolled at about 10,000 feet on standing lines fifty miles from the coast. The bombs generally approached at altitudes ranging from 1,000 to 8,000 feet so that the Type 14 coastal radars would be capable of giving close control instructions to the pilots well before the bombs crossed the patrol lines. Owing to the lack of any evasive action by the bomb the Tempest pilot would usually follow a pursuit curve, ending in a stern chase. Shooting had to be of the first quality for so small a target and strikes were only immediately lethal on the fuselage fuel tanks or warhead. Wastage of ammunition would only render a gap in the patrol line while the fighter returned for replenishment; however as more than one pilot found, frustrated by lack of ammunition, it was possible (if adequate speed margin existed) to fly alongside the bomb and with the wing tip nudge the target's wing up, so toppling the bomb's gyro-stabilised automatic pilot and causing it to dive into the sea.

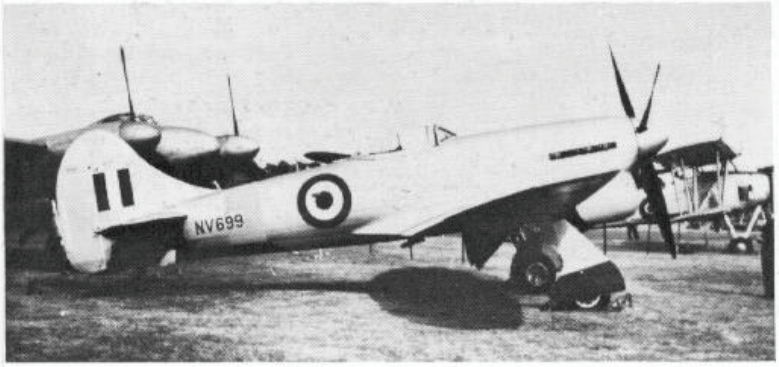
The bombs were not easy prey for, apart from being difficult to spot in poor light (dawn and dusk were often chosen for saturation attacks), if and when they were destroyed in the air, they blew up with such shattering effect that many a Tempest suffered damage from blast and debris.*

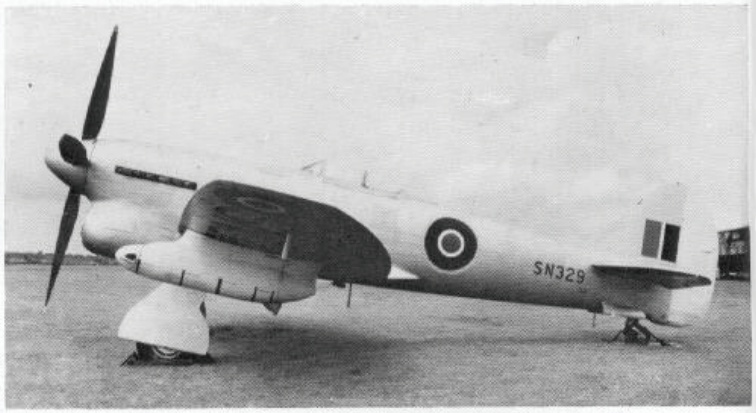
SUPPORTING THE ALLIED ARMIES

As the flying bomb threat withered when Allied forces overran the launching sites, the Tempest was virtually withdrawn from service for two months. Almost every engine required replacing or major overhaul, the few spring-tabbed aircraft were with-

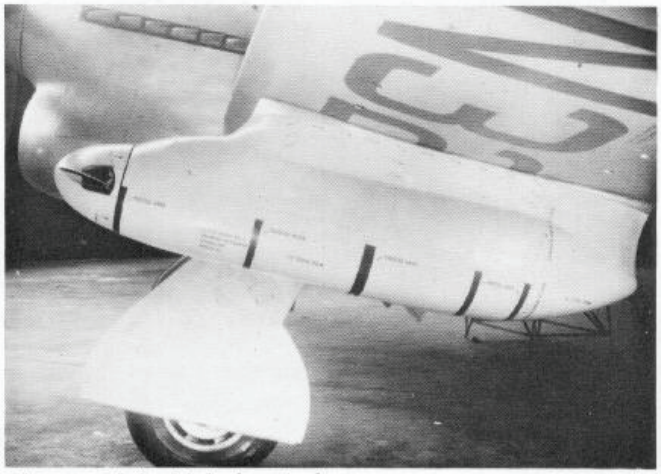
* *An interesting footnote to the Tempest's fight against the V.1 is provided by the use of a Tempest V by the Officer Commanding A.D.G.B., Air Marshal Sir Roderick Hill, K.C.B., M.C., A.F.C.; this Officer, whose aircraft carried the letters RH on the fuselage, flew more than twenty flying bomb patrol sorties in the Tempest, and forty in other fighters.*

An in-service Tempest T.T.5, NV699, *in natural metal finish on upper surfaces and traditional black and yellow stripes underneath. This aircraft served with No. 229 O.C.U.*
(Photo: F. K. Mason collection)

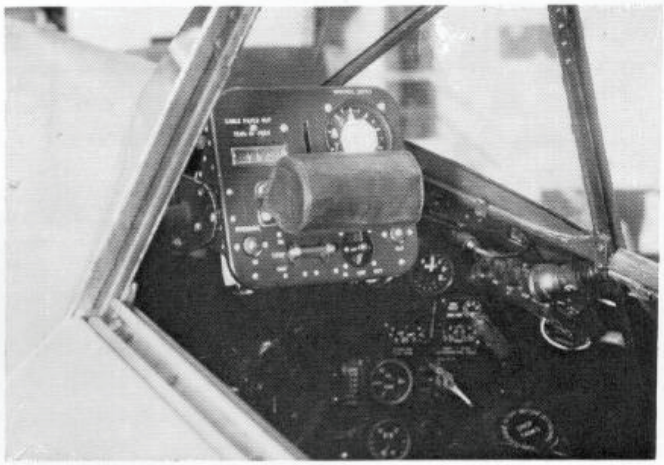




Trial installation of the Malcolm G-Type Winch Mk. II on Tempest V, SN329.
(Photo: Ministry of Defence Neg. No. 16813C)



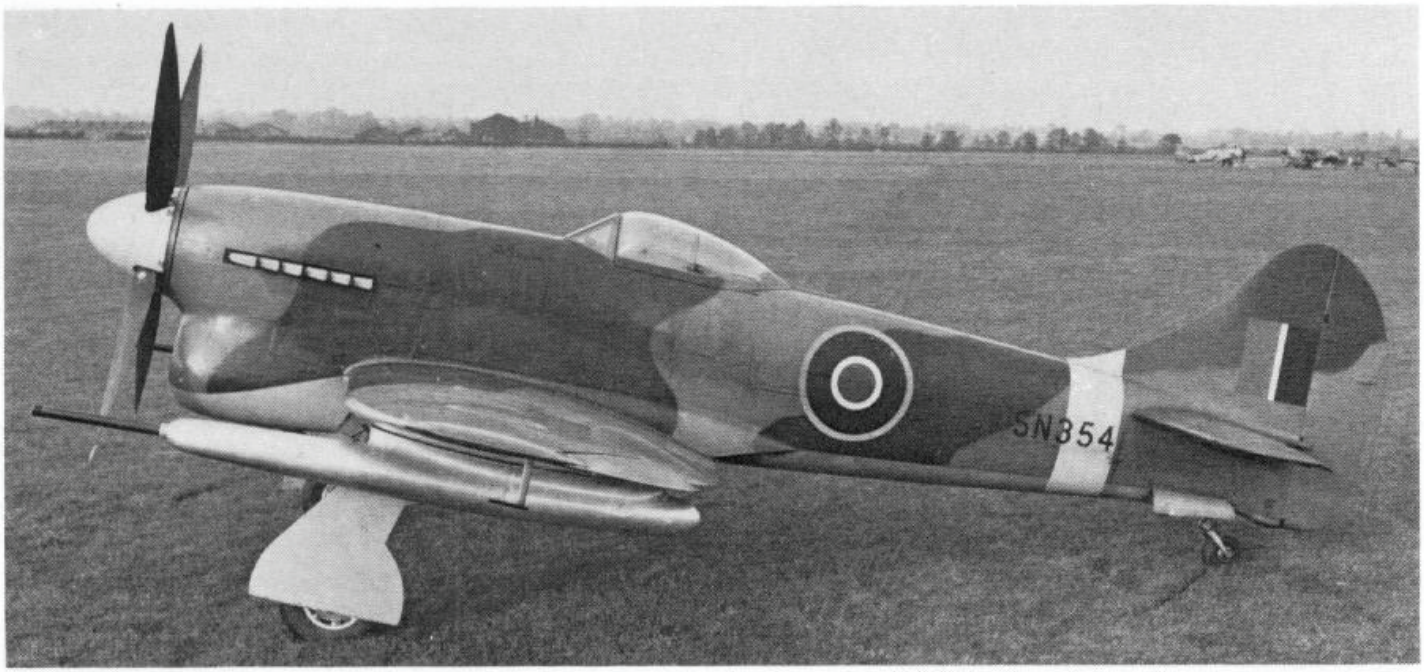
Close-up of the Malcolm winch.
(Photo: Ministry of Defence Neg. No. 16814B)



Cockpit of the Tempest T.T.V, showing the replacement of the gyro gunsight by the winch panel. Apart from the substantial crash pad, the panel displayed the winch windmill speed, length of cable payed out and operating controls.
(Photo: Ministry of Defence Neg. No. 16814E)

drawn (as experience had shown that the tabs allowed such manoeuvres as would damage the airframe), and pilots were given a short "rest" at O.T.U.s to train newcomers.

By December 1944 the Tempest was again ready for operations. No. 122 Wing, equipped with Tempest V Series 2s, was formed and flew to Holland with four Tempest squadrons (Nos. 56, 80, 274 and 486) and a Sptifire XIV squadron, No. 41. The pilots selected were those among the most experienced in the R.A.F. and were assigned two tasks, namely the systematic destruction of all targets of opportunity associated with German rail transport in



The post-war trial installation of twin Vickers "P" 40-mm. guns under the wings of SN354. *Seen here at Langley late in 1945, the aircraft later went to Boscombe Down.*
(Photo: Hawker Aircraft Ltd., Neg. No. ARM3)

Northern Germany, and the maintenance of air supremacy in this area by seeking and destroying, either in the air or on the ground, the new generation of high performance enemy fighters and bombers that were emerging from the widespread underground assembly plants by the end of 1944.

As the Allied armies approached the old frontiers of Germany so the Luftwaffe's defence became more bitter. German fighter-bombers sought to attack the enormous array of British and American tactical air forces based close behind the front line. In accordance with its task, No. 122 Wing, in the first twenty days destroyed more than fifty enemy fighters (among them several Me 262 jet fighters), eighty locomotives and countless military vehicles, for the loss of 21 Tempests.

On 1st January 1945 came the famous Operation Hermann, the astonishing mass attack by the *Luftwaffe* fighters and fighter-bombers on Allied airfields and depots, possibly without equal in the history of air warfare. Around 800 enemy aircraft staged a low-level strike against bases of the Second Tactical Air Force—which was almost entirely grounded by poor weather—destroying 144 Allied aircraft and damaging a further 84. By a stroke of fortune, Venlo was one of several bases that escaped attention, indeed most of 122 Wing's Tempests were themselves carrying out a sweep over Germany. Returning short of ammunition, they were almost powerless to intercept the enemy raiders but to some extent contributed to the score of 137 claimed as destroyed by Allied forces.

The final months of the War in Europe found No. 122 Wing in No. 83 Group, commanded by Air Vice-Marshal Sir Harry Broadhurst. The Tempests were in constant action both as fighter-bombers operating against ground targets in North Germany defended by veritable curtains of predicted light *flak*, and as fighters striving to catch the potent Me 262s. In his book, "The Big Show", Flight Lieutenant Pierre Clostermann gives many graphic accounts of the nightmare operations as a pilot on No. 274 (Fighter) Squadron—combats against Ta 152s, Me 262s, Ar 234s and Ju 88s, against enemy airfields, railways and factories.

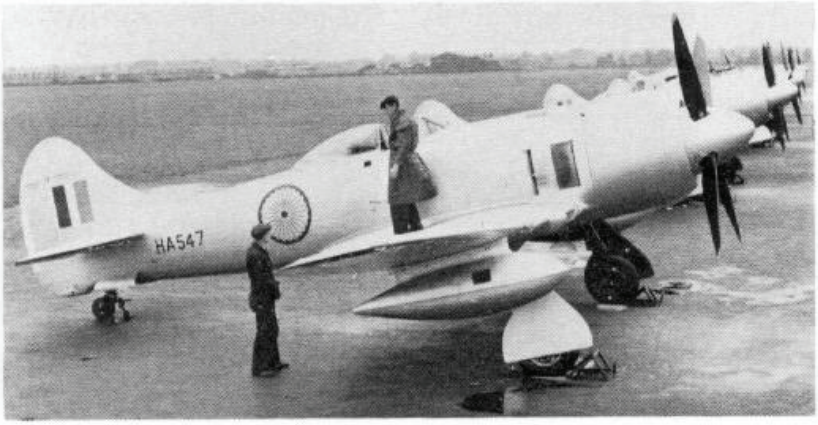
By VE-Day seven squadrons had been equipped with the Tempest V, and with the assumed run-down of available spares for the American fighters in service with the R.A.F., it was decided to standardise on the Tempest until such new aircraft as the Hornet, Meteor and Vampire could be introduced. The Typhoon had already begun phasing out, and with the run-down of operational squadrons after the War the maximum number of Tempest V squadrons never exceeded ten at any one time. Of these, four (Nos. 3, 16, 56 and 80—all in Germany) received the Tempest VI before converting to jet fighters.

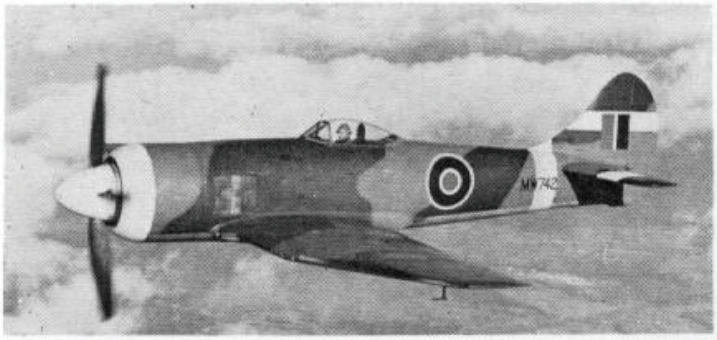
THE TEMPEST II

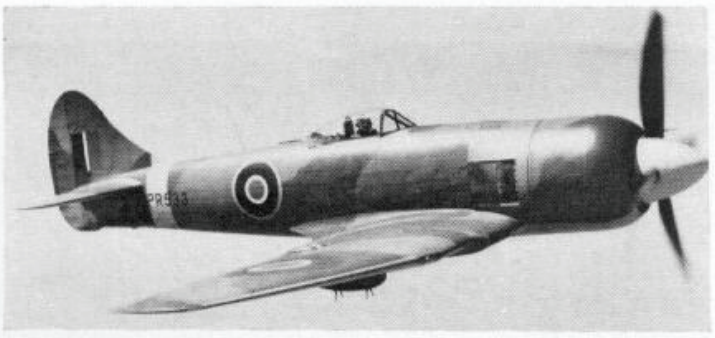
Had it not been for the protracted development difficulties with the Bristol Centaurus radial engine, the Tempest II would almost certainly have eclipsed the Mark V. As it was this rugged 440 m.p.h. version never saw action in Europe; indeed, as delay followed delay in 1943 and 1944, its whole operational concept became associated with the War against Japan.

As already stated, the Tempest II had been the result of the transfer of work on the Centaurus from the Tornado to the Typhoon II. The two prototypes, *LA602* and *LA607* (first flown during the summer of 1943), were followed by heavy production orders

A pre-delivery line-up of Indian Tempest IIs.
(Photo: Hawker Aircraft Ltd., Neg. No. 2TG2)







(Left) *An early Tempest II*, MW742, *displaying the distinctive identification stripes on fin, rudder and tailplane.* (Right) *A late-series Tempest II fighter-bomber*, PR533, *being flown by Bill Humble.* (Photos: Hawker Aircraft Ltd.)

placed with both Hawker Aircraft Ltd., and the Bristol Aeroplane Co. Ltd., no fewer than 1,048 being ordered by the end of 1944. It had also been intended that production of the Typhoon by Glosters would also be replaced by the Tempest II, but these plans were abandoned owing to the heavy priorities afforded to the Meteor in 1944.

Troubles with the Centaurus were diverse in nature. Vibration caused by a rigid engine mounting, inadequate crankshaft lubrication, overheating, exhaust seepage and reduction gear seizures all delayed finalisation of the production Centaurus V.

Of all these troubles the engine vibration occupied Hawkers most, and the eight-point rigid mounting was replaced by a six-point rubber-packed mounting, but the wear on the mounting pads caused this to be abandoned in favour of a more finely balanced airscrew. At one time the second prototype was flying with a five-blade Rotol propeller, but in view of the very fine limits of balance eventually achieved with the four-blader as well as the production stage reached with this unit, the five-blader's introduction did not come about until 1946-7 on the Sea Fury.

Production of the Mark II got under way slowly and the first Bristol-built aircraft, *MW374*, was not flown until 4th October 1944. Stocks built up at Aston Down and Kemble during the winter and throughout 1945 while clearance for service in the tropics was achieved. During the summer of 1945 plans were laid for the despatch, as part of Tiger Force, of fifty Tempest IIs to the Far East under the command of Wg. Cdr. Beamont, but the sudden end of the Pacific War overtook these plans, so that by October that year no fewer than 320 Mark IIs were in storage at these two Maintenance Units.

Final clearance of the Centaurus V and VI (with which the production aircraft were powered) allowed the first home-based squadron, No. 54 at Chilbolton—within easy reach of the M.U.s—to be formed, and this remained the only such first line unit so equipped. As if to underline the close association between the Typhoon/Tempest family and Wg. Cdr. Beamont, this pilot led the Victory Commemoration Fly-Past over London in a Tempest II on 8th June 1946.

Almost all the remaining aircraft were sent overseas to Nos. 16, 26 and 33 Squadrons in Germany, and Nos. 5, 20, 30 and 152 in India. No. 33 moved to Hong Kong with their Tempests in 1949, and afterwards to Malaya where they operated against the jungle terrorists until 1951 when they were replaced by de Havilland Hornets.

It was the very nature of the fortuitous stockpiling of "war-surplus" Tempest IIs that enabled relatively large numbers to be supplied to the Indian Air Force in 1947, combined with the technical back-up provided by similarly-equipped R.A.F. units in that country. A total of eighty-nine such aircraft was supplied, ultimately equipping three squadrons of the Indian Air Force. The following year twenty-four Tempest IIs were delivered to Pakistan, and both countries retained the type in service until 1953.

THE TEMPEST VI

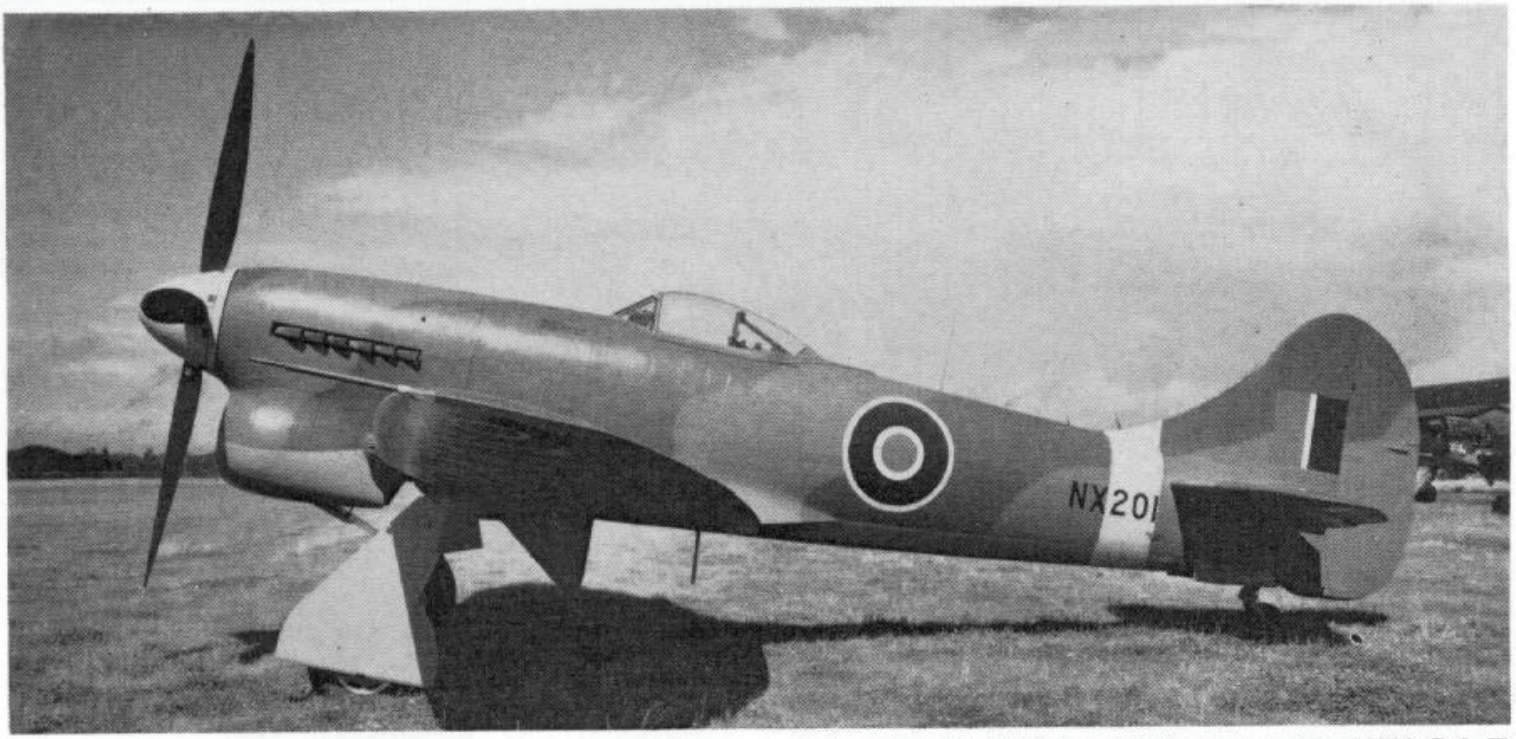
Least known of the Tempest family, the Mark VI was undoubtedly the most popular for, despite retention of the Sabre engine, the more fully developed Mark V engine with improved cooling and inclusion of spring tabs and strengthened rear spar bestowed almost limit-free performance and handling.

Like the Tempest II, the Mark VI did not see action during the War. The prototype was the original Mark V, *HM595*, much modified with Sabre V and fitted with carburettor intakes in the wing root leading edges together with a secondary oil cooler. The increased power of the Sabre demanded that a larger cooling area be provided in the radiator, thus necessitating removal of the oil cooler to the wing. In this form *HM595* was first flown by Bill Humble on 9th May 1944.

Quite early in the life of the Mark VI it was decided to send this version to the Middle East and in December 1944 *HM595* underwent tropical trials at Khartoum, the success of which delayed the production aircraft while tropical equipment was "designed into" the Tempest. As a means of speeding Service trials at Boscombe Down, two Tempest Vs, *EJ841* and *JN750*, were converted to Mark VI standard during 1945.

Two hundred and fifty production Tempest VIs were originally ordered from Hawker but the end of the War brought cancellation to all but 142. These equipped a total of nine R.A.F. squadrons, of which five were Middle East-based (Nos. 6 and 213 at Nicosia and Shallufa, No. 8 at Aden, and Nos. 39 and 249 at Habbaniyah) and four in Germany (Nos. 3, 16, 56 and 80). Few replacements were held in Europe as their service was expected to be shortlived, most of the spare aircraft being shipped to No. 109 Maintenance Unit at Fayid South and Shubra. They were however replaced in the Middle East commencing in 1949.

The Tempest survived until well into the nineteen-fifties as a target tug. A trial installation had been performed on a Mark V (*SN329*) in 1945 and this led to widespread conversion of Mark IIs, Vs and VIs for target towing, an air-driven winch drum being carried under the port wing. Tempest tugs served with the Armament Practice Stations at Acklington and Sylt, with No. 226, 229 and 233 Operational Conversion Units, as well as most of the operational squadrons.



Factory view of a Tempest VI, NX201. (Photo, dated August 1946, Ministry of Defence Neg. No. 14599 C & E)

A number of interesting trials were carried out by Tempests and the following extracts from Hawker flight test schedules are probably the best means of summarising these:

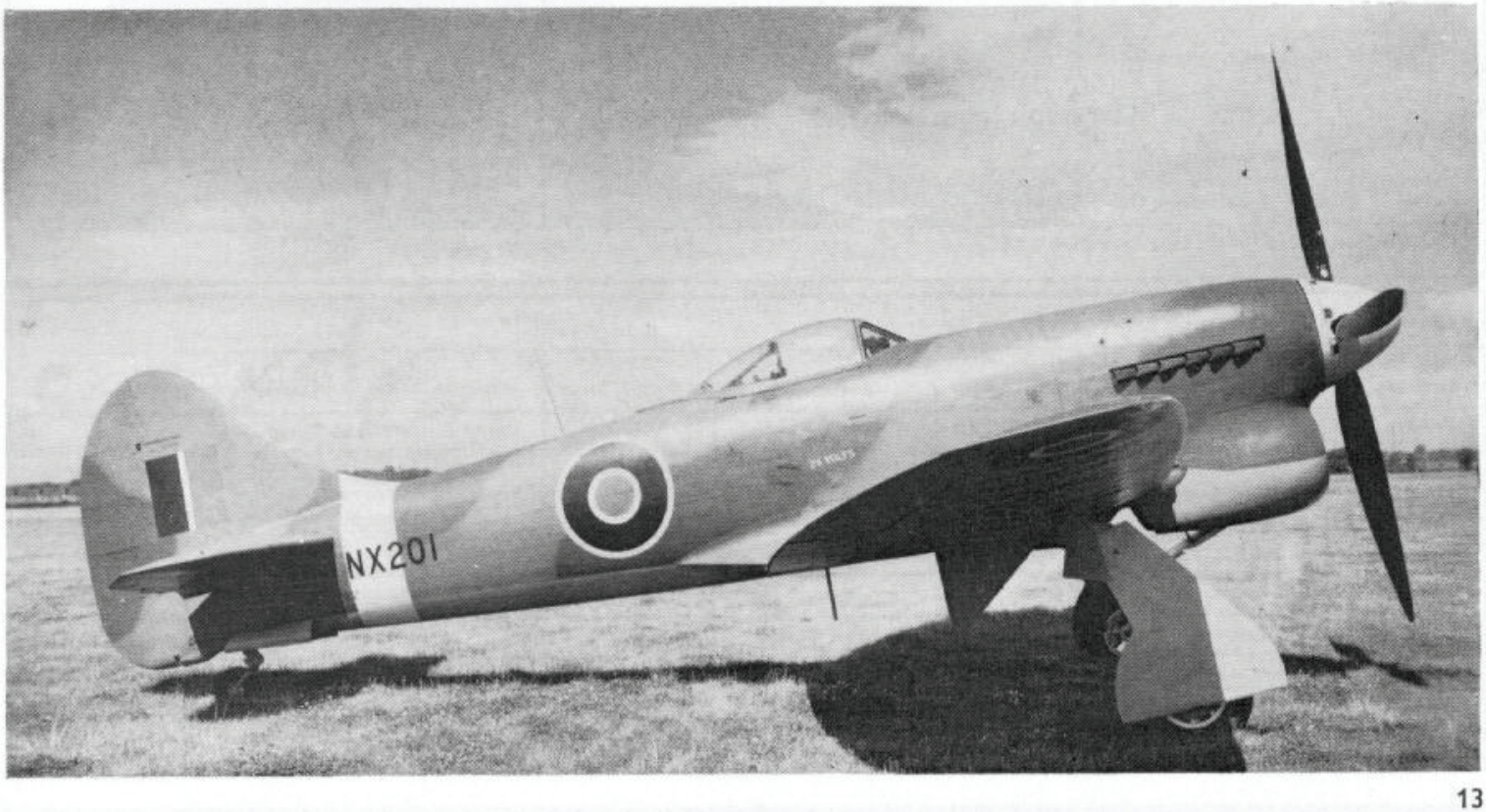
Date	Aircraft	Test	Pilot
12/9/44	Tempest V, *JN729*	Dive to M=0·76, clean aircraft	Frank Murphy
19/10/45	Tempest V, *SN354*	1st flight with 40-mm. "P"-guns	Bill Humble
19/3/46	Tempest V, *SN352*	Four 305 lb. R.P.s	Morell
16/11/45	Tempest II, *PR550*	Carriage of central drop tank	Morell
23/6/48	Tempest V, *SN329*	f.f. with Malcolm towing winch	T. S. Wade

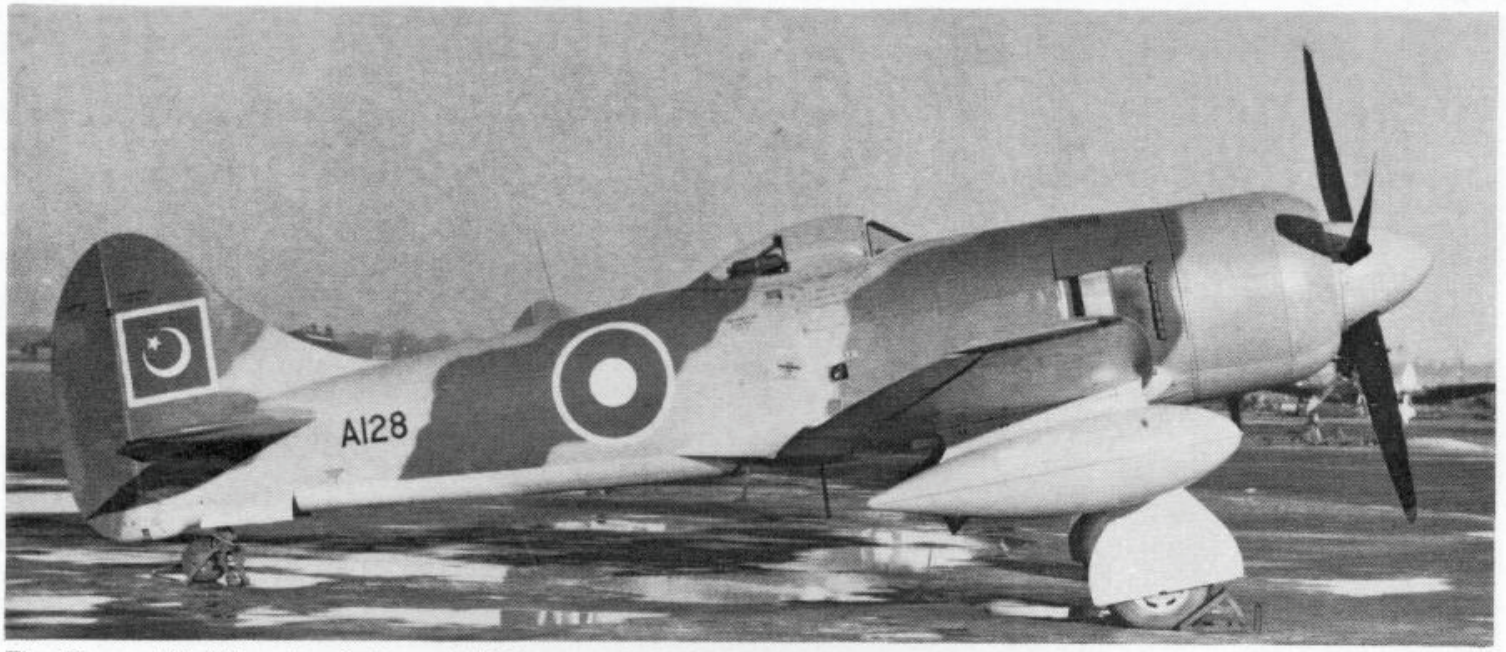
FLYING THE TEMPEST V

In the cockpit of the Tempest, while taxiing prior to take-off, perhaps the two most noticeable features were the bulk of the nose, caused by the large mass of the Sabre "H" engine, and the very powerful wheelbrakes although their severe misuse seldom induced ground-loops owing to the very wide track undercarriage.

At take-off the engine's great power gave rise to severe swing to the right, a tendency further aggravated by the use of flap. On the climb to 20,000 feet (changing to S-Gear at 10,000 feet) the best rate of climb was achieved at 185 m.p.h. indicated, reducing to 145 m.p.h. above 33,000 feet.

The controls were most effective above about 160 m.p.h., but the rudder had to be used firmly in a turn at all speeds. At low speeds the ailerons and elevator were sluggish, and for this reason and because the left wing dropped without warning at the stall, all aerobatics required plenty of speed and height, as well as full throttle at the commencement. When





First Tempest II delivered to Pakistan, A128 (*previously* PR866). (Photo: Hawker Aircraft Ltd.)

the spring tabs were withdrawn from service the old trouble of aileron "snatch" returned in high "g" manoeuvres resulting in wing drop, high speed stall, possible inversion and spin. The Tempest however responded quickly and positively to normal spin recovery.

For landing with flaps, having regard for their large area, the rate of descent was rapid and it was inadvisable to turn at speeds below 130 m.p.h. indicated; the approach was steep and, to the uninitiated, a trifle disconcerting, as lowering the flaps, radiator shutter and undercarriage, and throttling back all contributed to a nose-down trim change. It was customary to rejoin the airfield circuit at about 200 m.p.h., progressively reducing speed to about 100 m.p.h. (with throttle and full flap) on the final approach, touching down between 75 and 80 m.p.h.

To assess the flying characteristics of the Typhoon and Tempest according to the standards of other fighters of that time, it is interesting to compare their

Aircraft	Wing Loading
Spitfire IX	31·0 lb./sq. ft.
Spitfire XIV	35·1 lb./sq. ft.
Mustang III	39·1 lb./sq. ft.
Tempest V	44·8 lb./sq. ft.
Thunderbolt	47·4 lb./sq. ft.
Typhoon IB	48·0 lb./sq. ft.
Bf 109 G-6	43·1 lb./sq. ft.
Bf 109 K-4	43·0 lb./sq. ft.
Fw 190A-4	48·4 lb./sq. ft.
Ta 152	55·5 lb./sq. ft.

PRODUCTION SUMMARY

The Hawker Tempest II

No of aircraft	Manufacturer	Serial Nos.	Remarks
50	Bristol Aeroplane Co.	*MW374-423*	*MW435-478, MW491-536, MW548-589, MW591-633, MW645-686* and *MW699-732* (250 aircraft cancelled.)
100	Hawker Aircraft Ltd.	*MW735-778, MW790-835, MW847-856*	Langley-built; 54 sold to Indian Air Force.
Nil	Bristol Aeroplane Co.	—	300 cancelled. *PE885-927, PE939-966, PE978-999, PF112-158, PF171-213, PF225-266, PF280-319, PF333-367.*
322	Hawker Aircraft Ltd.	*PR525-567, PR581-623, PR645-689, PR713-758 PR771-815, PR830-876, PR889-921.*	468 cancelled: *PR922-928, PR941-967, PR979-999, PS115-157, PS173-215, PS229-273, PS287-329 PS342-387, PS408-449, PS463-507, PS520-563, PS579-625, PS637-681.*
Nil	Bristol Aeroplane Co.	—	30 cancelled: *VA386-395, VA417-436.*

Total Tempest IIs built: 472; *total cancelled:* 1,048.

The Hawker Tempest V

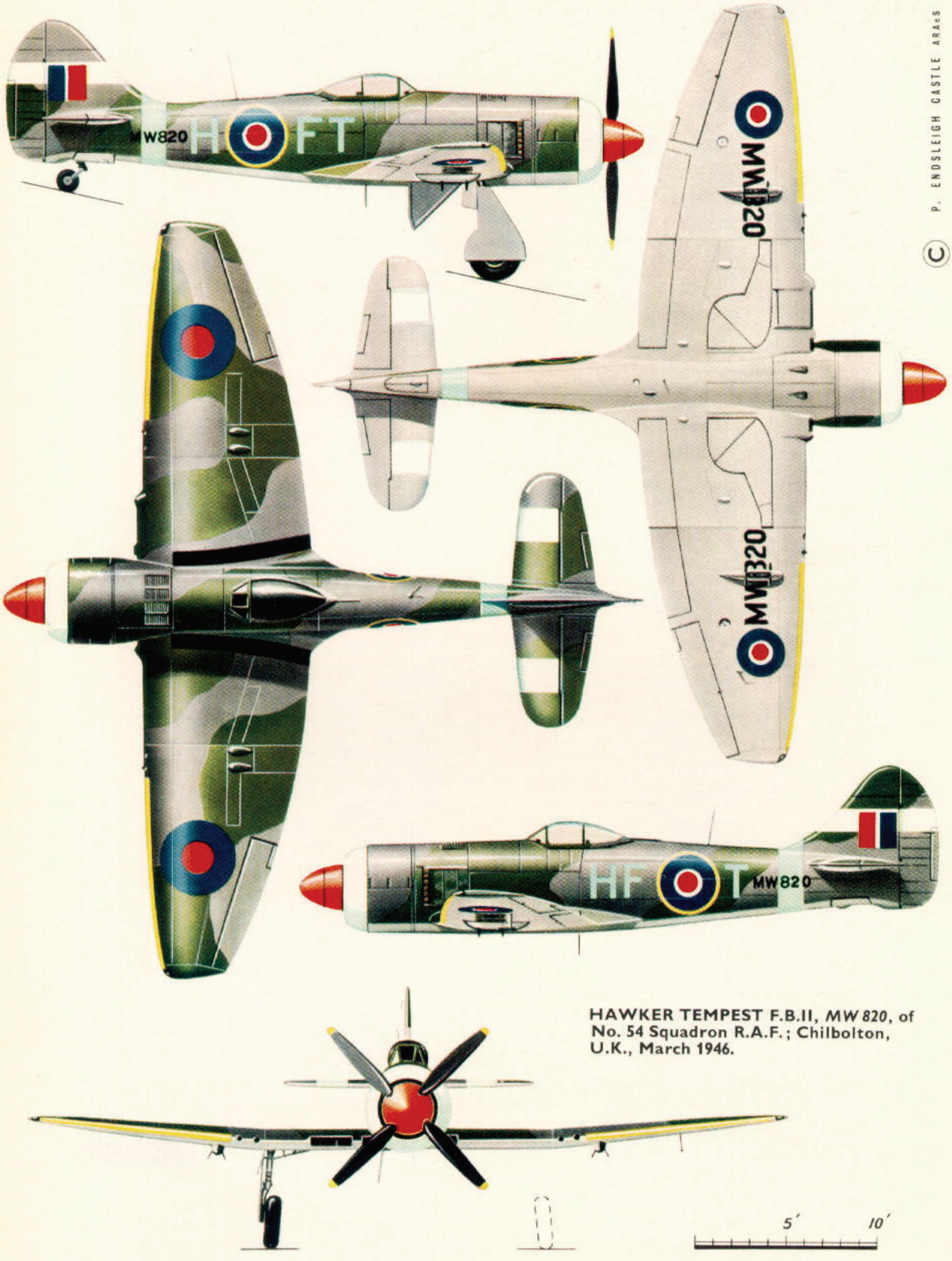
No. of aircraft	Manufacturer	Serial Nos.	Remarks
100	Hawker Aircraft Ltd.	*JN729-773, JN792-822, JN854-877*	*JN750* converted to Tempest VI.
300	Hawker Aircraft Ltd.	*EJ504, EJ518-560, EJ577-611, EJ626-672, EJ685-723, EJ739-788, EJ800-846, EJ859-896.*	*EJ841* converted to Tempest VI.
199	Hawker Aircraft Ltd.	*NV639-682, NV695-735, NV749-793, NV917-948, NV960-996.*	Many converted to target tugs.
201	Hawker Aircraft Ltd.	*SN102-146, SN159-190, SN205-238, SN253-296, SN310-355.*	49 cancelled: *SN368-416.*

Total Tempest Vs built: 800; *total cancelled:* 49.

The Hawker Tempest VI

142	Hawker Aircraft Ltd.	*NV995-999, NX113-156, NX169-209, NX223-268, NX281-288*	158 cancelled: *NX289-325, NX338-381, NX394-435, NX448-482.*

Total Tempest VIs built: 142; *total cancelled:* 158.



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HAWKER TEMPEST F.B.II, *MW 820*, of No. 54 Squadron R.A.F.; Chilbolton, U.K., March 1946.

wing loadings (at take-off weight), for therein lies the physical manifestation of the pilot's "feel" of an aircraft:

Production Summary

For ease of reference the following production summary is given in numerical order of Marks, rather than chronological order.

The Hawker F.10/41 Tempest I (previously known as Typhoon II). One prototype, *HM599*. Napier Sabre IV with wing radiators.

The Hawker F.10/41 Tempest II. Two prototypes, *LA602* and *LA607*. Bristol Centaurus IV engines.

The Hawker F.10/41 Tempest III and IV. Two prototypes, *LA610* and *LA614*. Rolls-Royce Griffon engines. *LA610* completed as F.2/43 Fury prototype, and *LA614* cancelled in 1943.

The Hawker F.10/41 Tempest V. One prototype, *HM595*, with Sabre II and Sabre V, later became prototype Tempest VI.

Representative Service Allocation

No. 3 (F) Sqdn., Mark Vs: *JN733* ("A"), *JN743* ("P"), *JN768* ("J"), *EJ669* ("B"), *EJ766* ("Z"), *EJ865* ("F"), *NV713* ("M"), *NV721* ("S"), *NV776* ("X"), *SN168* ("T"), *SN220* ("A"), *SN295* ("R"), *SN352* ("Q"); Mark VIs: *NX173*, *NX189*, *NX145*.

No. 5 (F) Sqdn., Mark IIs: *PR529*, *PR532*, *PR815*.

No. 6 (F) Sqdn., Nicosia and Shallufa, Mark VIs: *NX134* ("T"), *NX135* ("N"), *NX139* ("D"), *NX147* ("F").

No. 8 (F) Sqdn., Aden, Mark VIs: *NX130* ("J"), *NX131* ("A"), *NX152* ("P"), *NX169* ("G"), *NX180* ("J").

No. 20 Sqdn., India, Mark IIs: *PR551*, *PR552*, *PR553*, *PR801*.

No. 30 Sqdn., India, Mark IIs: *PR565*, *PR566* ("V"), *PR837*, *PR840*, *PR842*.

No. 33 (F) Sqdn., Germany, Mark IIs: *PR774* ("D"), *PR776* ("P"), *PR777* ("S"), *PR779* ("D"), *PR786* ("U"), *PR788* ("A"), *PR859* ("Z"); Mark Vs: *EJ880* ("R"), *EJ886* ("N"), *NV664* ("A"), *NV757* ("Y"), *SN127* ("J"), *SN161* ("G"), *SN210* ("V"), *SN342* ("I").

No. 39 (F) Sqdn., Middle East, Mark VIs: *NX172*, *NX197*.

No. 54 (F) Sqdn., Mark IIs: *MW379*, *MW398* ("N"), *MW747*, *MW820* ("T")

No. 56 (F) Sqdn., Mark Vs: *EJ547* ("A"), *EJ718* ("B"), *EJ721* ("C"), *EJ780* ("D"), *JN864* ("E"), *JN867* ("H"), *JN877* ("M"), *SN131* ("P"); Germany, Mark VIs: *NX124*, *NX223*, *NX231*.

No. 80 (F) Sqdn., Mark Vs: *EJ660* ("B"), *NV704* ("F"), *JN868* ("N"), *SN144* ("U"), *SN216* ("Y"), *SN313* ("Z").

No. 152 Sqdn., India, Mark IIs: *PR536*, *PR541*, *PR546*, *PR814*.

No. 183 Sqdn., Mark IIs: *MW747*, *MW763*, *MW772*, *MW790*, *MW811*.

No. 213 (F) Sqdn., Nicosia and Shallufa, Mark VIs: *NX136*, *NX180*, *NX183*, *NX192*, *NX227*, *NX241*, *NX248*, *NX256*.

No. 222 (F) Sqdn., Mark Vs: *SN178* ("B"), *SN182*.

No. 247 (F) Sqdn., Mark IIs: *MW390* ("C"), *MW392* ("M"), *MW395* ("F"), *MW396* ("T"), *MW794* (crashed 6/5/46).

No. 249 (F) Sqdn., Habbaniyah, Mark VIs: *NX120* ("T"), *NX125* ("Y"), *NX126* ("A"), *NX143* ("P"), *NX170* ("K"), *NX171* ("H"), *NX182* ("Q").

No. 274 (F) Sqdn., Mark Vs: *EJ525* ("K"), *EJ744* ("K"), *EJ864* ("A"), *NV702* ("E"), *NV747* ("S"), *SN145* ("D"), *SN183* ("J"), *SN189* ("K").

No. 287 (F) Sqdn., Mark Vs: *SN106*, *SN116*, *SN119*.

No. 486 Sqdn., R.N.Z.A.F., Newchurch and Holland, Mark Vs: *JN766* ("S"), *JN792* ("H"), *JN801* ("L"), *JN807* ("J"), *JN809* ("M"), *NV706* ("F"), *NV918* ("L"), *SN146* ("K"), *SN168* ("Q").

No. 501 (County of Gloucester) Sqdn., Mark Vs: *EJ520* ("L"), *EJ555* ("Y"), *EJ585* ("A"), *EJ591* ("Z"), *EJ603* ("M"), *EJ605* ("K"), *EJ608* ("D"), *EJ702* ("Q"), *EJ763* ("J"), *SN289* ("P"), *SN293* ("L"), *SN328* ("H").

Other R.A.F. Units. Mark IIs: Air Fighter Development Squadron, *MW743*, *MW744*, *MW754*; No. 226 O.C.U., Bentwaters, *PR555*, *PR811*, *PR870*; Empire Test Pilots' School, *MW775*, *MW791*, *MW813*, *MW818*, *PR867*; No. 13 O.T.U., *MW750*, *MW776*, *MW777*, *MW797*. Mark Vs: No. 56 O.T.U., *EJ631*, *EJ721*, *EJ810*, *EJ818*, *EJ838*, *EJ846*; No. 229 O.C.U., *EJ660*, *EJ744*; No. 233 O.C.U., *EJ669*, *EJ740*.

Trials and other aircraft, miscellaneous: Mark IIs: *MW737* (Centaurus XV test bed); *PR550* (90-gall. ventral fuel tank trials); Mark Vs: *EJ518*, *NV768* (Napier trials with annular radiators and ducted spinner); *JN751* (Wg.Cdr. R. P. Beamont's aircraft); *JN876* (Sir Roderick Hill's aircraft); *SN329* (prototype T.T.5 conversion); *SN354* (40-mm. "P"-gun experimental installation).

Aircraft sold to India, Mark IIs: *MW376-383*, *MW385-393*, *MW395-404*, *MW739*, *MW741-743*, *MW745*, *MW746*, *MW748*, *MW750-752*, *MW754*, *MW756*, *MW758-764*, *MW767-MW771*, *MW773*, *MW775*, *MW777*, *MW791*, *MW793*, *MW795-797*, *MW807-810*, *MW814*, *MW817*, *MW819*, *MW822-824*, *MW828-831*, *MW847*, *MW848*, *MW850-856*, *PR525*, *PR869*, *PR874*, *PR890*, *PR893*, *PR902*, *PR907* (total of 89 aircraft).

Aircraft sold to Pakistan, Mark IIs: *PR615*, *PR749*, *PR806*, *PR809*, *PR865*, *PR866*, *PR872*, *PR875*, *PR876*, *PR889*, *PR891*, *PR892*, *PR894*, *PR897-900*, *PR906*, *PR909*, *PR910*, *PR912*, *PR914*, *PR915*, *PR917* (total of 24 aircraft).

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SPECIFICATION

	Tempest I (1)	Tempest II (2)	Tempest V (3)	Tempest VI (4)
Type	Fighter Prototype	Single-seat, single-engine fighter and fighter-bomber.		
Powerplant	2,500-h.p. Napier Sabre IV 24-cyl. H-type liquid-cooled engine driving 4-blade Rotol or D.H. propeller.	2,520-h.p. Bristol Centaurus V or VI 18-cyl. air-cooled radial engine driving 4-blade rotol propeller.	2,180-h.p. Napier Sabre IIA, B or C 24-cyl. H-type engine driving Rotol or D.H. 4-blade propeller.	2,340-h.p. Napier Sabre V 24-cyl. H-type engine driving 4-blade Rotol propeller.
Armament	Four 20-mm. British Hispano Mk. I guns. 800 rounds.	Four 20-mm. British Hispano Mk. II or V guns with 800 rounds. With wing racks could carry two 1,000-lb. bombs, two 90-gall. drop tanks, two mines, or two 45-gall. napalm bombs. Normal R.P. load was eight 3 in. 60-lb. warhead rockets.		
Dimensions				
Wing span:	41 ft. 0 in.	41 ft. 0 in.	41 ft. 0 in.	41 ft. 0 in.
Length:	34 ft. 2 in.	34 ft. 5 in.	33 ft. 8 in.	33 ft. 10½ in.
Height:	15 ft. 10 in.	15 ft. 10 in.	16 ft. 1 in.	16 ft. 1 in.
Wing area:	302 sq. ft.	302 sq. ft.	302 sq. ft.	302 sq. ft.
Weights				
Empty:	8,950 lb.	8,900 lb.	9,000 lb.	9,150 lb.
Normal loaded:	11,300 lb.	11,500 lb.	11,500 lb.	11,700 lb.
Overload:	—	13,560 lb.	13,640 lb.	13,740 lb.
Loadings				
Wing:	37·4 lb./sq. ft.	44·9 lb./sq. ft.	44·8 lb./sq. ft.	45·5 lb./sq. ft.
Power:	4·52 lb./BHP	5·38 lb./BHP	6·25 lb./BHP	5·87 lb./BHP
Performance				
Max. speed:	466 m.p.h. at 24,500 feet	442 m.p.h. at 15,200 feet	436 m.p.h. at 18,500 feet	438 m.p.h. at 17,800 feet
Climb:	4¼ minutes to 15,000 feet	4½ minutes to 15,000 feet	5 minutes to 15,000 feet	4¾ minutes to 15,000 feet
Range: (Normal)	770 miles	805 miles	740 miles	750 miles
(Extra fuel)	—	1,640 miles	1,530 miles	1,560 miles
Service Ceiling:	39,000 feet	37,500 feet	36,500 feet	38,000 feet

Flight Report Measurements quoted in the following Type Test Reports:

(1) Flight Report No. L932, dated 20/6/43, signed R. P. Beamont (Aircraft *HM599*).

(2) Flight Report No. L1516, dated 27/11/45, signed F. Murphy (Aircraft *PR550*).

(3) Flight Report No. L1240, dated 30/5/44, signed W. Humble (Aircraft *JN740*).

(4) Flight Report No. L1604, dated 3/6/46, signed W. Humble (Aircraft *NX144*).

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by George Falkner & Sons Ltd., for McCorquodale City Printing Division, London.